Installation Instructions
D296 and D297
Long Range Beam Smoke Detectors

1.0 Description

The D296 and D297 are long range projected beam type smoke detectors which consist of a separate transmitter and receiver. Internal pointability provides coverage flexibility without the need for brackets. Automatic Signal Synchronization and Range Adjustment reduce installation costs. Selectable sensitivity and alarm response time provide installation flexibility.

2.0 Specifications

- **Operating Voltage:** D296: 18.0 to 32.0 VDC
  D297: 10.2 to 15.0 VDC
- **Standby Current:** D296: Receiver - 45 mA @ 24.0 VDC
  Transmitter - 20 mA @ 24.0 VDC
  D297: Receiver - 50 mA @ 12.0 VDC
  Transmitter - 20 mA @ 12.0 VDC
- **Receiver Alarm Current:** D296: 60 mA @ 24.0 VDC
  D297: 75 mA @ 12.0 VDC
- **Range** (distance between transmitter and receiver)**:** 30 to 350 ft. (9 to 107 m)
- **Spacing** (distance between systems): Allow no more than 60 ft. (18 m) between systems. Sixty foot spacing is confirmed by Underwriters Laboratories, Inc. testing.
- **Pointability:** Internally pointable optics for ±90° horizontal, and ±10° vertical adjustment.
- **Sensitivity:** Field selectable for 20, 30, 40, 50, 60, or 70 percent beam obscuration.
- **Alarm Contacts:** Normally Open contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- **Trouble Contacts:** Normally Closed contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- **Aux. Alarm Contacts:** Form "C" (NO, C, NC) contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- **Tamper:** Receiver: Access door tamper switch in series with trouble contacts.
  Transmitter: Upon cover's removal, cover tamper switch interrupts transmission.
- **System Signaling:** Conventional 4-wire system. Not for use with systems that incorporate an alarm verification feature.
- **Signal Delay:** **Fire**: Selectable 30 seconds or 5 seconds
  Trouble: 20 ± 2 seconds.
- **Temperature:** The storage and operating temperature range is -22° to +130°F (-30° to +54°C). *For UL Listed installations, the range is +32° to +130°F (0° to +54°C).*
- **Mounting:** The units are designed to be mounted to 4 in. (10 cm) square or octagonal electrical boxes (not supplied).
- **Listings and Approvals:**

UL	S3019
ULC	CS692
MSFM	Permit #1943
NY City MEA	Acceptance #MEA274-93-E
CSFM	#7260-1062:106
FM	Job #OX2A9.AY
CE	

- **Standard Accessories:** D306 Remote Test/Indicator Plate and Test Cable
- **Options:** D307 Remote Indicator Plate, D308 Field Test Kit, D309 Alignment Light, and D1005 Test Cord.

3.0 Principle of Operation

Each D296 or D297 beam smoke detector has a separate transmitter and receiver. The transmitter transmits an invisible infrared beam of a specific frequency and intensity. The receiver detects, then measures the beam's intensity (see Figure 1).

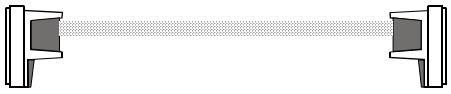


Figure 1 - Infrared Transmission

As the beam is obscured by smoke, the receiver senses a decrease in the signal strength and measures that decrease. The receiver compares the signal level with two preset thresholds: an alarm threshold which is set using the sensitivity switch and a trouble threshold which is preset at approximately 10%. If the signal falls below the alarm threshold for the programmed alarm period, the receiver signals an alarm (see Figure 2).

Figure 2 - Beam Obscuration

If the signal falls below the trouble threshold for more than 20 seconds, such as might happen if the beam is blocked by a foreign object, the receiver signals a trouble condition (see Figure 3).

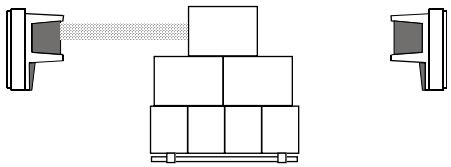


Figure 3 - Beam Blockage

The receiver automatically compensates for the gradual loss of signal due to dust/dirt build-up on the cover. After 50 percent of the signal is lost, the receiver will indicate a trouble. When the dust/dirt build-up is cleaned or the blockage is removed, the detector automatically goes back to its normal operation level.

A trouble will be indicated at the receiver if the beam strength is increased by more than 20% for greater than 20 seconds. Causes include improper initial alignment or the removal of a partial beam blockage at the time of alignment. Preform a fine-tune alignment (see Section 7.3).

4.0 Installation Considerations

The proper location and spacing of detectors is critical in a properly installed and operating fire alarm system. For best results, it is recommended that the detectors be located and spaced in accordance with the National Fire Protection Association (NFPA) Standard 72 "The National Fire Code." This standard is available at a nominal cost from The National Fire Protection Association, Batterymarch Park, Quincy, MA, 02269.

In all installations, good engineering judgement should prevail. The following are some general considerations:

- Do not use mirrors. The detectors should be installed with a clear line-of-sight between the transmitter and receiver.
- The beam path should be clear of moving objects.
- Set the sensitivity based on the distance between the transmitter and receiver. See Section 7.2 Sensitivity Adjustment.
- The detectors may be mounted directly to the ceiling or to side walls. Do not mount the units where the beam path may run parallel within 4 in. (10.2 cm) of a corner.
- For a sloped or peaked ceiling, the beam path should be located within 3 ft. (1 m) of the ceiling's peak.
- Stratification of air may hinder smoke from reaching detectors mounted close to the ceiling. Stratification occurs when smoke, rising because it is warmer than the surrounding air, reaches a level where it is the same temperature as the surrounding air and will not rise to the ceiling. If stratification is considered a possibility, extra beams should be installed where stratification is expected.
- Avoid areas subject to normal smoke concentrations such as kitchens and garages.
- Do not install units where normal ambient temperatures are below -22°F (-30°C) or above +130°F (+54°C).

The following are some specific installation considerations:

4.1 Avoid Sources of Heat and Air Movement

The detectors should be located where the beam path will not pass near heating and cooling outlets.

- Don't mount where hot or cold air can blow directly into the beam path.
- Heating, ventilating, and air conditioning systems can cause smoke to be blown away from the beam path.
  - Smoke must accumulate in the beam path to be detected.
- Heaters mounted close to the beam path can cause the beam to become distorted.

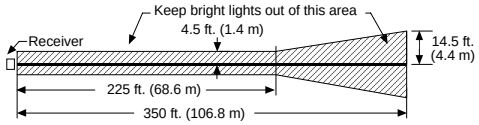
You can test for beam distortion by monitoring the signal voltage. After setup, the signal voltage of the detector should read 4 VDC. Monitor the voltage and turn on all heating and cooling devices in the area. The signal voltage should not fluctuate more than 0.20 VDC. If it does, the detector should be moved to avoid these disturbances.

4.2 Avoid sources of bright light

Sunlight and light from extremely bright sources such as the exposed bulbs of high pressure sodium, mercury vapor, and metal halide lights can cause stray signals. The receiver should not be pointed toward any of these sources.

Sunlight: Avoid pointing the receiver directly at the rising or setting sun. If you are installing the unit where sunlight can't be avoided, mount the receiver slightly higher than the transmitter and aimed down toward the transmitter. This should reduce this problem by causing the receiver to look below the horizon.

Bright Lights: Don't mount the receiver where it is looking at exposed bulbs of high pressure sodium, mercury vapor, and metal halide lights. The illustration below shows where these exposed lights should be avoided.



Bare fluorescent lights may also pose a problem especially in long hallways where a series of lights run perpendicular to the beam. Incandescent lights are not a problem as long as they are not directly in the beam path.

4.3 Use the correct wire gauge and length

Beam smoke detectors are often used to protect very large areas. This means that the wire runs used to power the detectors and signal alarm conditions can be very long. The voltage available at the end of very long wire runs may not be sufficient to power the detector, especially when the system is running on battery backup. It is very important that the correct wire gauge is used for these installations.

Use the following chart to determine the proper wire size, wire length and the number of transmitter and receiver pairs that can be used.

Wire Length	**Wire Size**		
	14 AWG (1.8 mm)	**16 AWG** (1.5 mm)	**18 AWG** (1.2 mm)
500 ft. (152 m)	20 pairs	13 pairs	8 pairs
1000 ft. (304 m)	10 pairs	6 pairs	4 pairs
2500 ft. (762 m)	4 pairs	3 pairs	2 pairs
5000 ft. (1524 m)	2 pairs	1 pair	1 pair

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4.4 Provide a stable mounting surface

Beam smoke detectors depend on the measurement of the projected beam to sense smoke. Therefore, shifts in the alignment of the beam due to movement of the transmitter/receiver can cause trouble or alarm conditions.

- **Always select a stable mounting surface.**
- **Never mount the unit to a suspended support such as a pipe or length of wood supported at only one end.**

This type of mounting can create a “pendulum effect” which greatly multiplies even very small movements at one end of the support. For example, a 2 in. (5.1 cm) movement translates into a beam misalignment of over 20 ft. at 350 ft. (6 m at 107 m).

Mounting surfaces should be supported at opposite corners to reduce the pendulum effect.

- **Always select surfaces not subject to building movement.**

The automatic compensation circuits of the D296 and D297 will eliminate most problems created by normal building expansions and contractions. In some unusual circumstances, the walls and support structure may be subject to more significant movement due to the operation of heavy equipment, such as cranes, anchored to the top of the walls.

When in doubt about mounting surface stability, measure the signal voltage of the detector. This voltage should be 4.0 VDC. Misalignment of the beam can cause this voltage to increase or decrease. The detector will indicate a trouble condition when the voltage increases to more than 4.8 VDC, or when it decreases to less than 2.0 VDC over a long period of time or to 0.4 VDC greater than 20 seconds. For more information on reading this voltage, see Section 8.3.

If movement of the mounting surface is suspected, relocate the detector to a surface that does not move or add supports to the mounting surface to prohibit movement.

- **DO NOT overtighten the mounting screws.**

When the detector is mounted to an electrical mounting box [4 in. (10 cm) square or octagonal], the mounting plate may bow as a result of the mounting box screw tabs being below flush with the top edges of the mounting box. Overtightening the mounting screws bows the mounting plate inward at the bottom, causing the optics to aim low.

Irregularities in the flatness of the mounting box edge surfaces or screw tabs will worsen this condition. Using only mounting boxes with flat, regular surfaces and properly formed screw tabs, and tightening the mounting screws to secure the mounting plate to 2 in/lb torque will minimize any misalignment caused by bowing of the mounting plate.

4.5 Consider the effects of stratification in cold environments

In very cold environments such as unheated warehouses, smoke may cool very quickly and is less likely to rise to the ceiling. Consider additional units at lower mounting heights to help compensate for this situation.

4.6 Consider the expected Fire load

When designing a fire alarm system, consider the expected fire load within the application.

For instance, fires caused by the ignition of flammable petroleum-based liquids usually result in a rapid buildup of heavy smoke. When these types of fires are probable, use sensitivity settings 0 or 1 which provide a response time of 5 seconds.

5.0 Mounting

NOTE: This product is not designed for use in outdoor applications.

Install a 4 in. (10 cm) square or octagonal electrical box (not supplied) to a rigid surface that will not be subject to movement or vibrations.

NOTE: If not mounting to an electrical box, be sure the surface will not be subject to movement or vibrations. For example: do not mount directly to a suspended ceiling without extra support.

- Remove the receiver's access door (1 screw), then remove the cover (4 screws). See Figure 4.

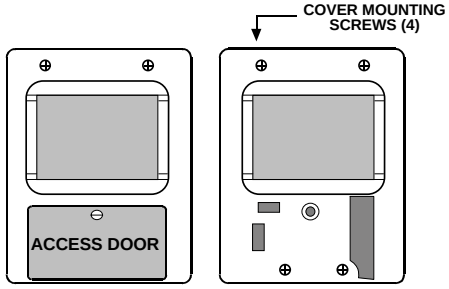

Figure 4 - Access Door and Cover

- Remove the receiver’s backplate by removing the single mounting screw from the top of the circuit board carrier plate then separating the two plates (see Figure 5).

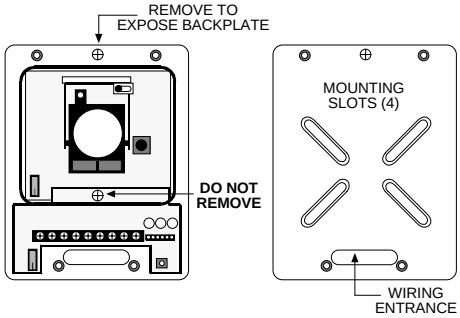

Figure 5 - Removing the Backplate

- Bring wiring from the electrical box through the wire entrance.

NOTE: All wiring should be unpowered.

- Securely mount the backplate to the electrical box.
- Return the circuit carrier plate to the backplate. Secure it in place with the single mounting screw.
- Repeat this mounting procedure for the transmitter.

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6.0 WIRING

CAUTION

Only apply power after all connections have been made and inspected.

- Wire the transmitter and receiver terminals as follows (see Figure 6).

NOTE: Do not install on verified fire circuits.

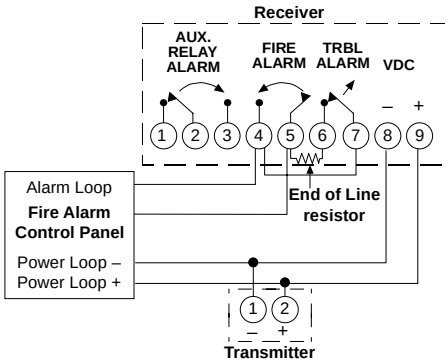

Figure 6 - Wiring a Single Unit

NOTE: Do not coil excess wiring inside the units.

- **Transmitter Terminals 1 & 2:**
  Input power terminals. See section 2.0 for the operating voltages of the D296 and D297.

- **Receiver Terminals 1, 2 & 3:**
  Form "C" Auxiliary relay contacts. Terminals 1 & 2 will open on fire alarm; Terminals 2 & 3 will close (short) on fire alarm.

- **Receiver Terminals 4 & 5:**
  Normally Open Fire alarm contacts will close (short) on fire alarm.

- **Receiver Terminals 6 & 7:**
  Normally Closed Trouble contacts will open for trouble alarm.

- **Receiver Terminals 8 & 9:**
  Input power terminals. See section 2.0 for the operating voltages of the D296 and D297.

NOTE: Resetting from a fire alarm requires power to the receiver to be interrupted for at least one second. If not provided by the fire panel, it can be accomplished by installing a switch in series with Terminal 9.

Remote Indicator Plate
The D306 Remote Indicator Plate is shipped with the D296 as a standard accessory. Although the Remote Indicator Plate is not required, the manufacturer recommends its installation to provide a means of checking the condition of the detector from ground level.

If a D306 or D307 Remote Indicator Plate will be used, install the Remote Indicator Connector to the receiver now (see Figure 7).

NOTE: The D307 remote indicator should be located no further than 100 ft. (30.5 m) from the receiver and wired with 18 AWG (1.2 mm) or larger wire. The D306 may be wired up to 500 ft. (152 m) from the receiver.

- Slide the Remote Indicator Connector over the pins just to the right of the receiver's terminal strip.

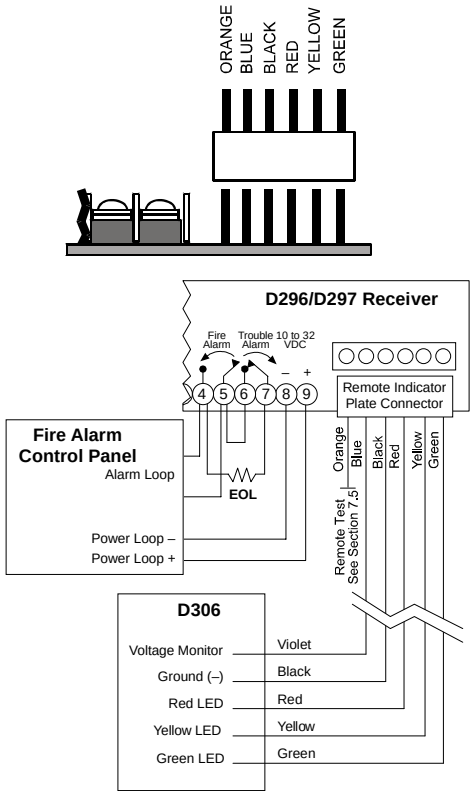

Figure 7 - Connecting the D306 Remote Indicator Plate

NOTE: If connecting a D307 Remote Test/Indicator Plate, consult the D307 Installation Guide (P/N: 32071).

7.0 SET-UP

Before starting this section, confirm that all connections have been made and are secure, then apply power to both units.

- Press the Aim Mode button (directly above the green LED) on the transmitter (see Figure 8). This allows the transmitter to power up while its cover is off.

  - Check the transmitter's green LED. It should be flashing on and off.

  - If the LED is off, check for the presence of power and proper polarity on Terminals 1 (–) & 2 (+).

  - A steady green LED indicates a faulty transmitter, and the unit should be returned to the factory.

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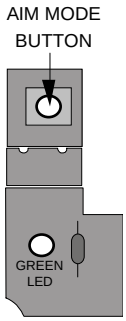

Figure 8 - Cutout View of Transmitter Circuit Board Showing Aim Mode Button Location

- Check the three receiver LEDs (see Figure 9).

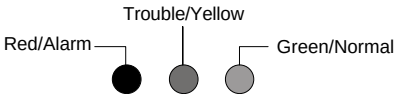

Figure 9 - Receiver's LEDs

  - It is normal for all of them to be on at this time, with the green indicator either flashing or constantly on.

  - If all are off, check for the presence of power and proper polarity on Terminals 8 (–) & 9 (+).

- Mount a D309 Strobe Aiming Light or equivalent (e.g. Faraday 5508) as close to the receiver as possible (preferably on top of the receiver).

  - Point it at the transmitter as your guide for aiming (an aiming light may not be necessary for short distance separations).

7.1 Preliminary Alignment

Each optical module is equipped with two alignment mirrors (one on each side) for initial alignment (see Figure 10).

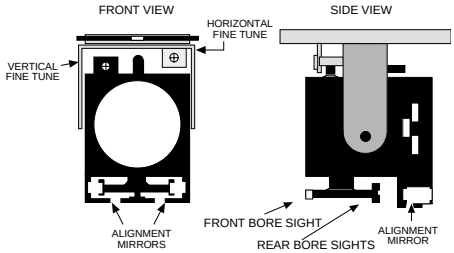

Figure 10 - The Optical Module

To initially align an optical module, look into either mirror from a side angle at least 2 ft. (61 cm) from the module. The optical module is pointed at objects seen in the mirror when the orange colored front bore sight is in the center of the rear bore sights (see Figure 11).

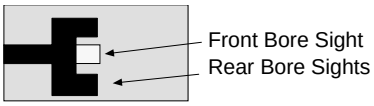

Figure 11 - View of the Alignment Mirror with Bore Sights Aligned Properly.

HINT: Use alignment sights like aiming a gun.

- Rotate the transmitter's optical module left or right until the image of the aiming light (or receiver image, if aiming light is not used) can be seen in the mirror.
  - If initially aimed too high or low, adjust the Vertical Fine Tuning adjustment allen screw (with supplied allen wrench) slightly up or down until the image is found.

- Use the Vertical Fine Tuning adjustment screw and the Horizontal Fine Tuning adjustment screw to fine tune the image to the center of the mirror (in-line with the front and rear bore sights).

- Replace and secure the transmitter's cover when this alignment procedure is complete.

- Check the transmitter's green LED. It should be flashing.

- Replace and secure the transmitter's access door.

- Align the receiver to the image of the transmitter using the above preliminary alignment procedure.

- Check the receiver's green LED. It should be flashing. This indicates that the preliminary alignment is complete.

  - If the receiver's green LED is not flashing, repeat the preliminary alignment procedure for the receiver.

7.2 Sensitivity Adjustment

Use the chart below (Figure 12) to aid in the sensitivity adjustment.

Recommended Settings			
Switch Setting	**Sensitivity**	**Alarm** Response	**Beam Length**
0	30%	5 sec.	30-100 ft. (9 -31 m)
1	60%	5 sec.	100-350 ft. (31 -107 m)
2	20%	30 sec.	30-50 ft. (9 -15 m)
3	30%	30 sec.	45-75 ft. (14-23 m)
4	40%	30 sec.	70-100 ft. (21 -31 m)
5	50%	30 sec.	90-140 ft. (27-43 m)
6	60%	30 sec.	120-180 ft. (37-55 m)
7	70%	30 sec.	160-350 ft. (49-107 m)

Figure 12 - Recommended Settings Chart

NOTE: Positions 8 and 9 are not valid positions. They are **not** to be used.

- Select the appropriate sensitivity setting from the above chart based on the distance between the transmitter and receiver.

- Set the receiver's Sensitivity switch at this setting.

- The Sensitivity switch is located just to the right of the optical module on the receiver. The indicator or pointer marking runs along the side of the switches' shaft (see Figure 13).

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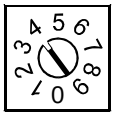

Figure 13 - Sensitivity Switch

- The recommended settings chart lists distances with some settings that overlap. For more sensitive detection, select the lower number setting. For better immunity to false alarms, select the higher number setting.

7.3 Fine Tune Alignment

- Connect the supplied D1005 Test Cable to Pins 1, 2 and 3 of P6, the group of pins located just to the right of the receiver's terminal strip (see Figure 14).

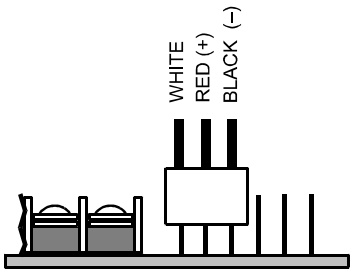

Figure 14 - D1005 Connection

  - Temporarily disconnect the Remote Indicator Plate connector, if installed.

- Connect a 20,000 Ohm/volt (or greater) DC VOM to the black (–) and red (+) leads of the D1005.

  - Set meter scale so that readings of 0.0 to 5.0 VDC can be read.

- Check the three LEDs on the receiver.

  - If the beam is being received by the receiver, the green LED should be flashing, and the red and yellow LEDs should be on steady.

  - If the green LED is on steady, the beam is not reaching the receiver. If this is the case, the preliminary alignment procedure should be attempted again.

- Observe the meter readings and adjust the receiver's optical module using the Horizontal and Vertical Fine Tuning adjustment screws for a maximum reading on the meter. **This is the most critical process of alignment. For the most effective operation of this system, the peak voltage during fine tune alignment must be obtained.**

NOTE: When performing fine tune alignment, keep arms and hands away from the front of the receiver and out of the beam path.

- The maximum voltage peaked reading will vary depending on the distance between the transmitter and receiver. The acceptable peaked voltage range is 0.50 to 5.00 V. The voltage at the receiver is greater at shorter distances. It is very important to peak the voltage to insure a stable trouble free detector.

Hint: Make a note of the alignment voltage. It may be helpful if future troubleshooting is necessary.

- After completing the fine tune alignment, remove the test cable, then replace and secure the receiver's cover.

- Check the status of the receiver's green LED. It should still be flashing.

- With the meter still connected to the test cable, re-install the test cable to P6 through the opening in the cover (red lead towards center of unit).

- An alarm test may be performed here if desired by connecting the white and black wires of the D1005. To reset the unit, temporarily remove power.

- Press the receiver's Set-up button located just below the P6/test cable connection (see Figure 15). **Press only if the covers are on both transmitter and receiver.**

  - This starts a one to two minute automatic internal setup process that results in a reference voltage for measuring beam blockages.

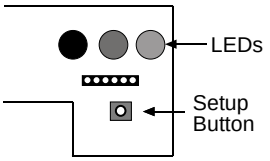

Figure 15 - The Receiver's Set-up Button

  - The red and yellow LEDs should turn off, and the green LED will turn on steady. After some voltage fluctuations, the meter should settle at 5.0 VDC.

NOTE: Be careful not to block the beam or move the units during this time.

  - At the end of the setup period, the receiver's green LED will flash, and the voltage will drop to between 3.8 and 4.2 VDC. This is a reference voltage that later readings can be compared to when determining the need for cleaning.

- If the voltage is not between 3.8 and 4.2 VDC, push the Set-up button again.

- After set-up is complete, remove the test cable (and reconnect the Remote Indicator Plate connector if used).

- Replace and secure the access door.

8.0 Other Information

8.1 Fire Alarm Reset

To reset the receiver after a fire alarm has occurred, remove power from the receiver for at least one second, then re-apply (see also, Power Outage, section 8.4).

8.2 Cleaning

At least once a year, the outside of the covers should be cleaned with a common window cleaner and a soft, clean cloth. Under normal conditions, this should not result in a trouble alarm as long as the beam is not continuously blocked for more than 18 seconds. After cleaning, recheck the reference voltage. If the voltage is less than 3.8 VDC, or greater than 4.2 VDC, calibrate the units (see section 8.3.)

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8.3 Reference Voltage Calibration

The reference voltage of the detectors should be checked at least once a year (or more often if required by local regulations or authorities having jurisdiction). **Clean covers are necessary for proper reference voltage readings.**

To check the reference voltage, remove the receiver's access door and measure the reference voltage, using the supplied test cable, or measure the voltage at the D307 Remote Indicator Plate (if used). If the voltage is less than 3.8 VDC, remove the cover and perform a fine tune alignment including use of the Set-up switch. If above 4.2 VDC, press the Set-up button. Calibration is not necessary if the voltage is between 3.8 and 4.2 VDC.

8.4 Power Outage

When power is removed, then reapplied to the receiver (such as in a power outage or alarm reset), the original reference voltage information is lost.

If the cover is on at the time of power-up, the receiver will automatically restart the internal set-up process (to get a new reference voltage) when power is applied. If the cover is off, the Set-up button will have to be pressed after the cover is reattached.

8.5 Remote Indicator Plate Connector

Momentarily connecting the orange and black leads of the connector (see Figure 16) will produce a test alarm. For a remote test, install a momentary switch between the orange and black wires.

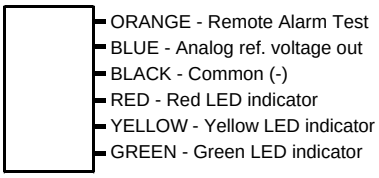
ORANGE - Remote Alarm Test
BLUE - Analog ref. voltage out
BLACK - Common (-)
RED - Red LED indicator
YELLOW - Yellow LED indicator
GREEN - Green LED indicator

Figure 16 - Remote Indicator Plate Connector

The black and blue wires may be connected to an analog meter for reference voltage measurements. The red, yellow, and green wires may be connected to remote LEDs.

Each wire is current limited to a maximum of 10.0 mA DC.

8.6 Smoke Density/Obscuration Information

The total obscuration of the infrared beam is dependent upon the density and width of the smoke cloud along the beam path. As the width of the smoke cloud increases along the beam path, less dense smoke will be needed for an equal obscuration of the beam path. In practice, the smoke cloud is assumed to be the entire distance of the beam path; therefore, the total obscuration required for alarm should be selected by setting the Sensitivity Pot as recommended in section 7.2.

Since the total obscuration of the beam by smoke increases with distance between the units (because more smoke will be within the beam path), the detector can be made less sensitive as the distance increases. Additionally, the sensitivity of the detector should be made less at greater distances because obscuration by other contaminants such as dust increases. The sensitivity should be set to respond to the proper smoke obscuration and also to reduce the chance of a false activation.

As shown in Figure 17, if the expected smoke density is 0.5 percent per ft. (per 30 cm), the obscuration at 50 ft. (15 m) is 20 percent and at 250 ft. (95 m) it is 73 percent.

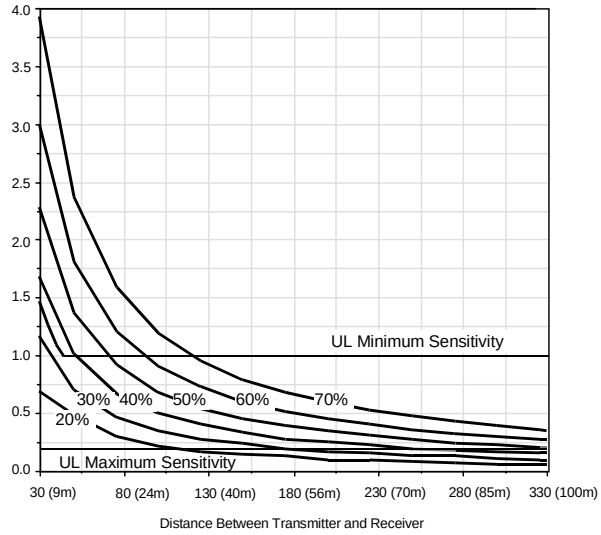

Figure 17 - Smoke Density/Obscuration Chart

The next chart (Figure 18) shows the Sensitivity Pot Setting (total obscuration) that is needed for alarm.

Sensitivity Pot Setting	**Total** Obscuration at Alarm
2	20%
0 or 3	30%
4	40%
5	50%
1 or 6	60%
7	70%

Figure 18 - Sensitivity Pot/Obscuration Chart

8.7 Field Sensitivity Measurements

The detectors automatically compensate for the effects of dust or dirt accumulation on the covers and for component aging. The NFPA requires that the detector's sensitivity be measured in the field, and requires that these measurements be made within one year after initial installation and every alternate year thereafter (reference NFPA 72). A D308 Test Kit should be ordered to test the unit's sensitivity in the field. The chart (Figure 19) below represents alarm information for the filters in the D308 as well as the Sensitivity Test Kit provided with the units.

Sensitivity Setting	**Must NOT** Alarm	**MUST** Alarm
2	0% (no filter)	40% filter
0 or 3	0% (no filter)	60% filter
4	20% filter	60% filter
5	20% filter	80% filter
1 or 6	40% filter	80% filter
7	40% filter	80% filter

Figure 19 - Sensitivity/Response Chart

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The Sensitivity Test Kit (supplied) may be used to check the sensitivity of the detectors during installation only. For field testing, the D308 must be used. Each filter decreases the detector's signal by a defined amount. When each filter is placed in front of the receiver's optical module for at least 30 seconds (5 seconds for position 0 or 1), the approximate sensitivity setting of the installed detector can be determined by the detector's response as shown in Figure 19.

NOTE: Testing these detectors will activate a fire alarm. Be sure to inform all concerned personnel before performing and testing.

8.8 FCC Compliance Notice

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in strict accordance with the manufacturer's instructions and recommendations, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from the receiver.
- Consult the installing company or an experienced radio/TV technician for help.

The booklet, "How to Identify and Resolve Radio-TV Interference Problems," prepared by the Federal Communications Commission (FCC) may prove helpful. This booklet is available from the U. S. Government Printing Office, Washington, DC 20402. Please specify Stock No.004-000-00345-4.

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9.1 TRANSMITTER TROUBLESHOOTING CHART

LED	CONDITION	SOLUTION
Flashing	Normal	
OFF	1. No power at the transmitter. 2. Aim Mode button not pressed 3. Faulty transmitter	1. Restore power to Terminals 1 and 2 2. Press Aim Mode button 3. Replace transmitter

9.2 RECEIVER TROUBLESHOOTING CHART - AIM MODE

RED LED	YELLOW LED	GREEN LED	TERMINALS 4 & 5	TERMINALS 6 & 7	CONDITION	SOLUTION
ON	ON	Flashing	Open	Open	Alignment OK.	
ON	ON	ON	Open	Open	Beam blocked or receiver misaligned.	Clear beam path or realign receiver.
ON	Flashing	Flashing	Open	Open	Invalid sensitivity setting.	Set to proper setting.
ON	OFF	OFF	Open	Open	No power.	Check for power at Terminals 8 & 9.

NORMAL OPERATING MODE

RED LED	YELLOW LED	GREEN LED	TERMINALS 4 & 5	TERMINALS 6 & 7	CONDITION	SOLUTION
OFF	OFF	ON	Open	Closed	Receiver initializing. Should stabilize in 60 to 120 seconds.	
OFF	OFF	ON	Open	Open	Receiver initializing. Access door is missing or loose.	Replace access door.
OFF	OFF	Flashing	Open	Closed	Normal condition.	
OFF	OFF	Flashing	Open	Open	Access door is missing or loose.	Replace access door.
OFF	ON	ON	Open	Open	Trouble. Beam is blocked or misaligned.	Clear beam path or realign receiver.
OFF	ON	Flashing	Open	Open	Trouble. If reference voltage is less than 2 VDC, dust on lens reduced signal strength or vibration misaligned the receiver.	Clean transmitter and receiver covers. If reference voltage doesn't return to 4.0 VDC, realign receiver and press set-up switch.
OFF	ON	Flashing	Open	Open	If reference voltage is greater than 4.8 VDC, beam strength has increased due to initial beam misalignment or removal of a partial blockage at time of setup.	Perform a fine-tune alignment of the receiver including use of setup button.
ON	OFF	Flashing	Closed	Closed	Alarm.	Determine cause of alarm; reset receiver.
ON	OFF	Flashing	Closed	Open	Alarm. Access door is missing or loose.	Determine cause of alarm; reset receiver. Replace the access door.
ON	ON	ON	Closed	Open	Alarm and Trouble. Alarm occurred then beam was blocked.	Determine cause of alarm; reset receiver. Clear the beam path.

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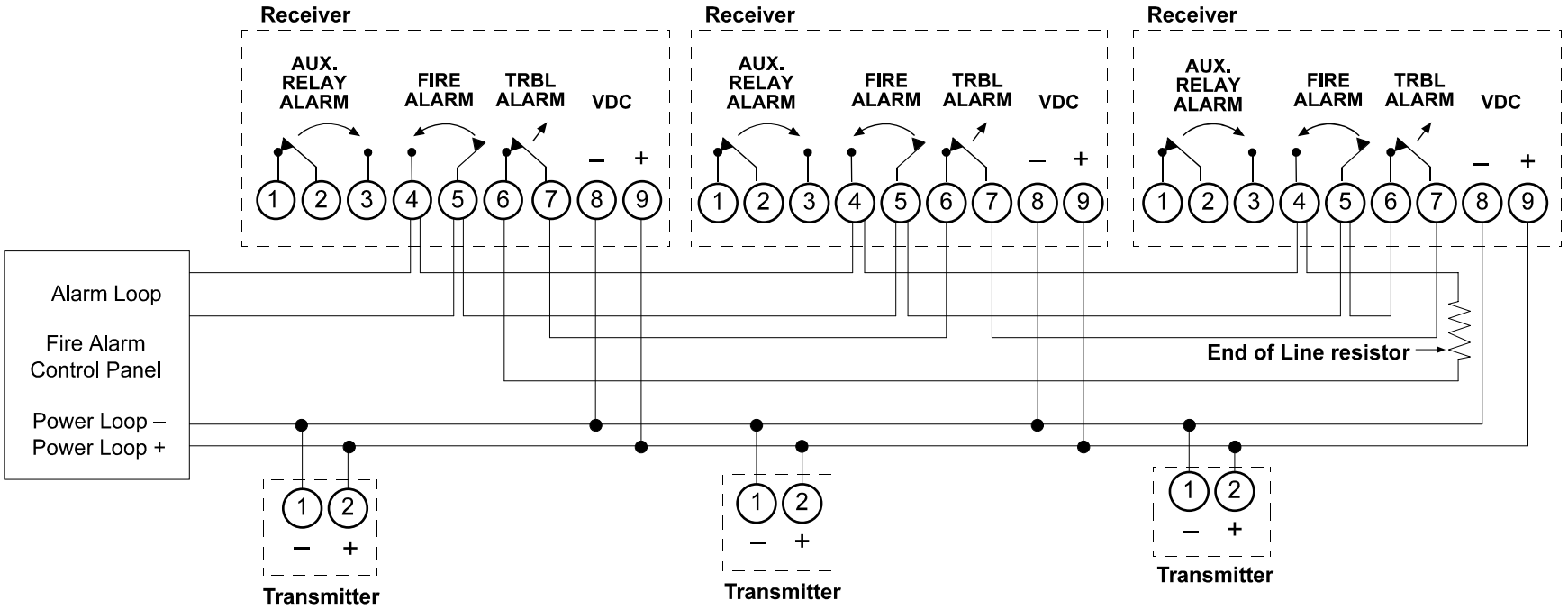

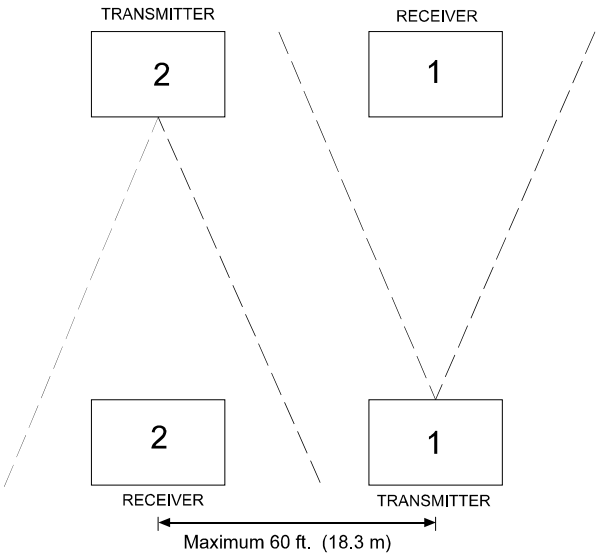

Transmitter / Receiver Placement

MULTIPLE UNITS:
For smooth, flat ceilings, mount units so that a spacing of no more than 60 ft. (18.3 m) exists between beam paths (with no more than one-half of that spacing between beam path and side wall [wall parallel to beam path]). Other spacings depend on ceiling height, airflow characteristics, and response requirements. The minimum spacing between adjacent units is 1/10th of the distance between transmitter and receiver. (If beam length is 300 ft. (91 m), units should be at least 30 ft. (9.1 m) apart).

NOTE: When two or more adjacent units are installed in the same area, it is recommended that transmitter and receiver locations are alternated. If not alternated, spacing must be 1/5th the distance from the transmitter to the receiver.

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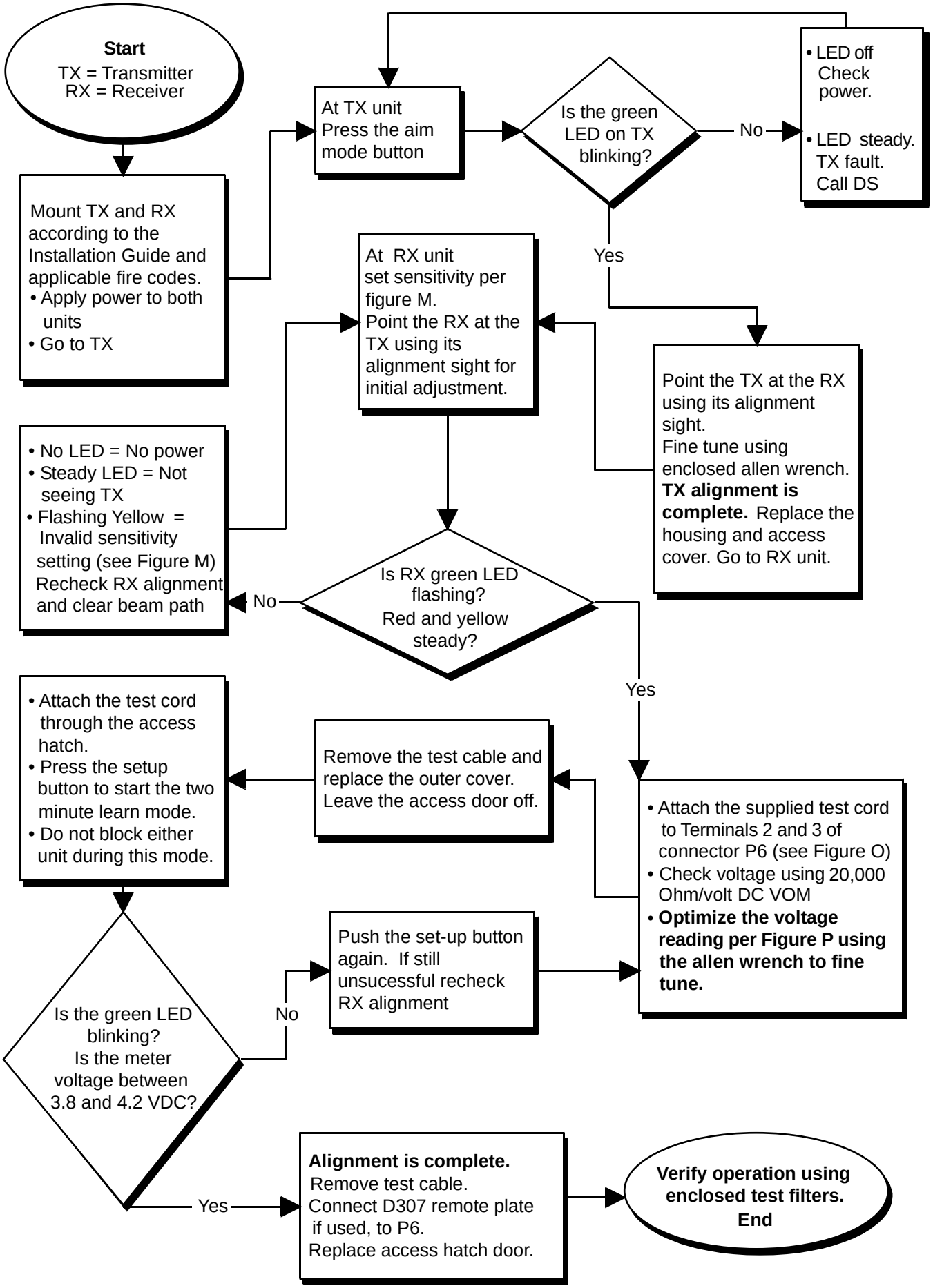
11.0 Quick Start Installation Flow Chart


Start
TX = Transmitter
RX = Receiver
Mount TX and RX according to the Installation Guide and applicable fire codes.
• Apply power to both units
• Go to TX
At TX unit
Press the aim mode button
Is the green LED on TX blinking?
No
• LED off
Check power.
• LED steady.
TX fault.
Call DS
Yes
At RX unit
set sensitivity per figure M.
Point the RX at the TX using its alignment sight for initial adjustment.
Point the TX at the RX using its alignment sight.
Fine tune using enclosed allen wrench.
TX alignment is complete. Replace the housing and access cover. Go to RX unit.
• No LED = No power
• Steady LED = Not seeing TX
• Flashing Yellow = Invalid sensitivity setting (see Figure M)
Recheck RX alignment and clear beam path
No
Is RX green LED flashing?
Red and yellow steady?
Yes
• Attach the test cord through the access hatch.
• Press the setup button to start the two minute learn mode.
• Do not block either unit during this mode.
Remove the test cable and replace the outer cover.
Leave the access door off.
• Attach the supplied test cord to Terminals 2 and 3 of connector P6 (see Figure O)
• Check voltage using 20,000 Ohm/volt DC VOM
• Optimize the voltage reading per Figure P using the allen wrench to fine tune.
Push the set-up button again. If still unsucessful recheck RX alignment
No
Is the green LED blinking?
Is the meter voltage between 3.8 and 4.2 VDC?
Yes
Alignment is complete.
Remove test cable.
Connect D307 remote plate if used, to P6.
Replace access hatch door.
Verify operation using enclosed test filters.
End

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